

**WHAT IS CLAIMED IS:**

1. A forming apparatus configured to cooperate with a vacuum structure for the vacuum-forming of a malleable injection molded plastic article, comprising:

a porous member formed from a porous material, the porous member including (i) an inside surface that is profiled to reflect at least a portion of an outside surface of the molded plastic article, and (ii) a vacuum coupling structure;

wherein the vacuum coupling structure of the porous member is configured cooperate with the vacuum structure, in use, to provide a reduced pressure adjacent the inside surface of the porous member to cause the portion of the outside surface of the malleable molded plastic article, within the porous member, to contact the inside surface of the porous member so as to cause a substantial portion of the outside surface of the malleable article, upon cooling, to attain a profile substantially corresponding to the profile of the inside surface of the porous member.

2. The forming apparatus of claim 56, wherein the vacuum coupling structure comprises an outside surface of the porous member.

3. The forming apparatus of claim 56, wherein the vacuum coupling structure comprises at least one channel formed in an outside surface of the porous member.

4. The forming apparatus of claim 56, wherein at least a portion of an outer surface of the porous member comprises a mounting surface configured to connect with an inside surface of a cooling tube.

5. The forming apparatus of claim 56, further configured to cooperate with a plug for providing a closed end to the profile of the inside surface of the porous member, the plug being shaped to correspond to a domed end portion of the molded plastic article.

6. The forming apparatus of claim 58, further comprising at least one vacuum channel configured to be coupled to the at least one channel formed in an outside surface of the porous member.

7. The forming apparatus of claim 56, wherein the inside surface of the porous member includes a closed end that is

shaped to correspond to a domed end portion of the molded plastic article.

8. The forming apparatus of claim 62, wherein the porous member further includes a channel extending therethrough at a base of the closed end thereof, the channel being configured to be connected to a low pressure source to draw the molded plastic article into the tube assembly.

9. The forming apparatus of claim 56, wherein the porous member has porosity in the range of about 3-20 microns.

10. The forming apparatus of claim 56, wherein the porous member comprises a porous aluminum.

11. The forming apparatus of claim 56, further including a cooling structure configured for connection with a heat dissipation path, for cooling the molded plastic article in contact with the inside surface of the porous member.

12. A device for receiving and cooling a semi-molten plastic article, the cooling device comprising:

a porous member having (i) an internal surface configured to receive the semi-molten article, and (ii) an external surface;

wherein, in use, the porous member is configured such that the semi-molten article is moved substantially against the internal surface by a pressure differential between the external surface and the semi-molten article.

13. The device according to Claim 67, further comprising low pressure structure for applying the pressure differential between the external surface and the semi-molten article.

14. The device according to Claim 67, wherein the porous member is configured as a removable insert to be removable from an injection molding tube assembly.

15. An apparatus for use in a post mold device, comprising:

a tubular porous member configured to be removably installed within the post mold device, the tubular porous member having (i) a porous inside surface, and (ii) a porous outside surface, the porous inside surface and the porous outside surface being configured to provide a pressure differential therebetween to cause a nonsolid molded plastic article within the porous member to contact at least a

portion of the porous member inside surface so that a profile of the molded plastic article reflects a profile of the porous member inside surface.

16. The apparatus according to Claim 70, further comprising a channel configured to provide low pressure to the tubular porous member outside surface.

17. The apparatus according to Claim 70, further comprising a vacuum device, coupled to the channel, to cause both (i) an exterior cylindrical surface of the molded plastic article and (ii) an exterior distal end of the molded plastic article to contact the interior surface of the porous member.

18. A forming apparatus configured to cooperate with an evacuation pump for the vacuum-forming of a malleable injection molded plastic article, comprising:

a porous member having a porous inside surface that supports the evacuation of air therethrough to cause, in use, a malleable molded article within the at least one porous member to expand to contact the porous inside surface to cause a substantial portion of the outside surface of the malleable article, upon cooling, to attain a profile

substantially corresponding to the profile of the inside surface of the porous member.

19. A tool configured to be carried by an injection molding robot arm, comprising:

a carrier configured to (i) be coupled to the injection molding robot arm, and (ii) carry a at least one molded article cooling device;

at least one porous member installed in the at least one molded article cooling device, the at least one porous member having a porous inside surface that supports the evacuation of air therethrough to cause a malleable molded article within the at least one porous member to expand to contact the porous inside surface; and  
an evacuation structure configured to evacuate the air through the at least one porous member.

20. An injection mold robot, comprising;

an arm member configured to be disposed adjacent an injection molding machine;

a carrier configured to (i) be coupled to the arm member, and (ii) carry at least one molded article cooling device;

at least one of porous member configured to be removably installed in the at least one molded article cooling device, the at least one porous member having a porous inside surface that supports the evacuation of air therethrough to cause a malleable molded article within the at least one porous member to expand to contact the porous inside surface; and

an evacuation structure configured to evacuate the air through the at least one porous member.

21. An injection molding machine, comprising:

mold structure that molds at least one plastic articles;

at least one cooling cavity configured to hold and cool the at least one plastic article after they are molded by the mold structure;

at least one porous member configured to be removably installed in the at least one cooling cavity, respectively, the at least one porous member having a porous inside surface that supports the evacuation of air therethrough to cause a non-solid molded plastic article within the at least one porous member to expand and contact the at least one porous member inside surface, a profile of the molded plastic article corresponding to a profile of the porous member inside surface; and

an evacuation structure configured to evacuate the air through the at least one porous member.

22. A molded plastic article, comprising:

a closed end:

an open end;

an inside surface; and

an outside surface;

a portion of the outside surface having a profile corresponding substantially to a porous cooling cavity inside surface which has pores that are configured to provide, in use, a low pressure sufficient to cause the molded plastic article to expand and contact the cooling cavity inside surface, the portion of the molded plastic article outside surface having structure which corresponds substantially to the pores of the porous cooling cavity.

23. A molded plastic article with a shape of at least a portion of its outside surface defined by a profiled inside surface of a porous member, the molded plastic article formed by the process of:

(i) receiving a malleable molded plastic article into the porous member;



(ii) evacuating the air surrounding the molded plastic article through the inside surface of said porous member causing the portion of the outside surface of the molded plastic article to move into contact with the profiled inside surface of the porous member, thereby to attain a shape substantially corresponding to the profiled inside surface; and

(iii) extracting heat from the molded plastic article through a heat dissipation path to solidify the molded plastic article sufficiently such that the outer shape of the molded plastic article is preserved;

whereby the portion of the outside surface of the molded plastic article takes on a surface finish reflecting that of the profiled inside surface of the porous insert.

24. The molded plastic article according to claim 53, wherein the porous member is formed of a porous substrate with the profiled inside surface having interstitial spaces preferably within a range of about 3 to 20 microns.

25. The molded plastic article according to claim 53, wherein molded plastic article is a preform.